Quarterly Progress Report

Stanford Synchrotron Radiation Laboratory

January through March
2003

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A. SPEAR 3 PROJECT SUMMARY

1. Technical Progress

In general most of the technical systems have been completed; however, completion of some components, particularly in the Vacuum, RF, and I&C areas will extend to June and July. This delay should not impact the installation program which was initiated on schedule starting March 31, 2003. The installation completion is scheduled for the end of October 2003.

All of the support rafts for the main ring magnets have been completed and are awaiting the completion of the last three vacuum chambers for assembly with magnets. The raft supports for the 4 matching cells have been aligned and grouted in Building 750 using the same technique that will be used in the SPEAR tunnel. The LCW headers for the standard cell girders were received and modified by the manufacturer to meet geometrical tolerances. Upon completion of pre-assembly these 16 units were placed in storage until installation in the ring. The magnets for the injection beam transport system have been completed and measured. The septum magnet for injection was fabricated and measurements will be completed in April.

The assembly welding and vacuum processing of 51 arc section vacuum chambers was completed with bake-out of the last 3 chambers scheduled for April. Assembly within magnets will be completed in June. Other work that is continuing beyond April 1 includes final manufacturing and assembly of bellows, straight section components, RF transition sections, PPS stoppers, and the DCCT monitor. Details and schedule are presented in Section 1.2.

All magnet power supplies are in fabrication or have been fabricated. Those power supplies that are on-site have been bench tested. The finishing touches on power supply rack assembly and wiring are being made as Intermediate Power Supplies arrive from IE Power. The delivery of the remaining Dipole Bulk Power Supply and the deliveries of the remaining sixty Intermediate Power Supplies are on track to support SPEAR 3 installation. A contract was placed for removal of existing supplies in a first phase followed by building refurbishment and new equipment installation in a second phase. The subcontract placement is fully congruent with the April 1, 2003 installation start.

One of several klystrons manufactured or repaired by SLAC is scheduled to be delivered to SPEAR 3 in May. The High Voltage Power Supply for the SPEAR 3 klystron was moved into its final location, which was a challenge because of the 46,500 lbs of the device. The RF Cavities being fabricated at Accel. Instru. in Germany have experienced delays due to electro-forming problems. The new electro-forming process appears successful and two of the four cavities have finished the forming process. The first assembled unit will be tested in April. The revised schedule leaves sufficient time to assemble and test the cavities before installation in August 2003. The low-level RF system prototype modules are complete. The final modules are in fabrication. Work on software changes for SPEAR 3 has made good progress.

Work on the computer control system continued with the configuration of the power supply control software, progress with the BPM data acquisition system, and the implementation of other remote control applications. Digital control components for the corrector power supplies are in production and acceptance testing has begun. Testing of commercial BPM processing units continued. The design of the computer-interfaced controller has begun. Work on I&C interconnection diagrams continued, and detailed cable specifications have begun.

Phase 1 of the cable plant installation was completed March 24, 2003. This mainly includes power, signal, and monitoring cables that could be installed outside of the tunnel and within the power supply building. Preparations for Phase 2 are near completion. Phase 2 will include final connections in the tunnel, power supply building and the control room. A contract for this work is out to bid.

During the second quarter of FY 03, SPEAR 3 accelerator physics group focused efforts on 3 GeV booster tests, Day-1 lattice specifications, construction of the synchrotron light monitor and further development of application programs. Detailed plans for the overall beam commissioning effort are underway.

In the ES&H area, the SPEAR 3 Safety Analysis Document was completed in March. Preparations are underway for the Accelerator Readiness Review (ARR) which is planned for July. The ARR will address the following areas:

- Identification of equipment and systems having safety importance – Hardware Readiness.
- Identification of procedures necessary for safe operation – Procedure Readiness.
- Identification of personnel necessary for safe operation and the definition of minimum training requirements – Training Readiness.

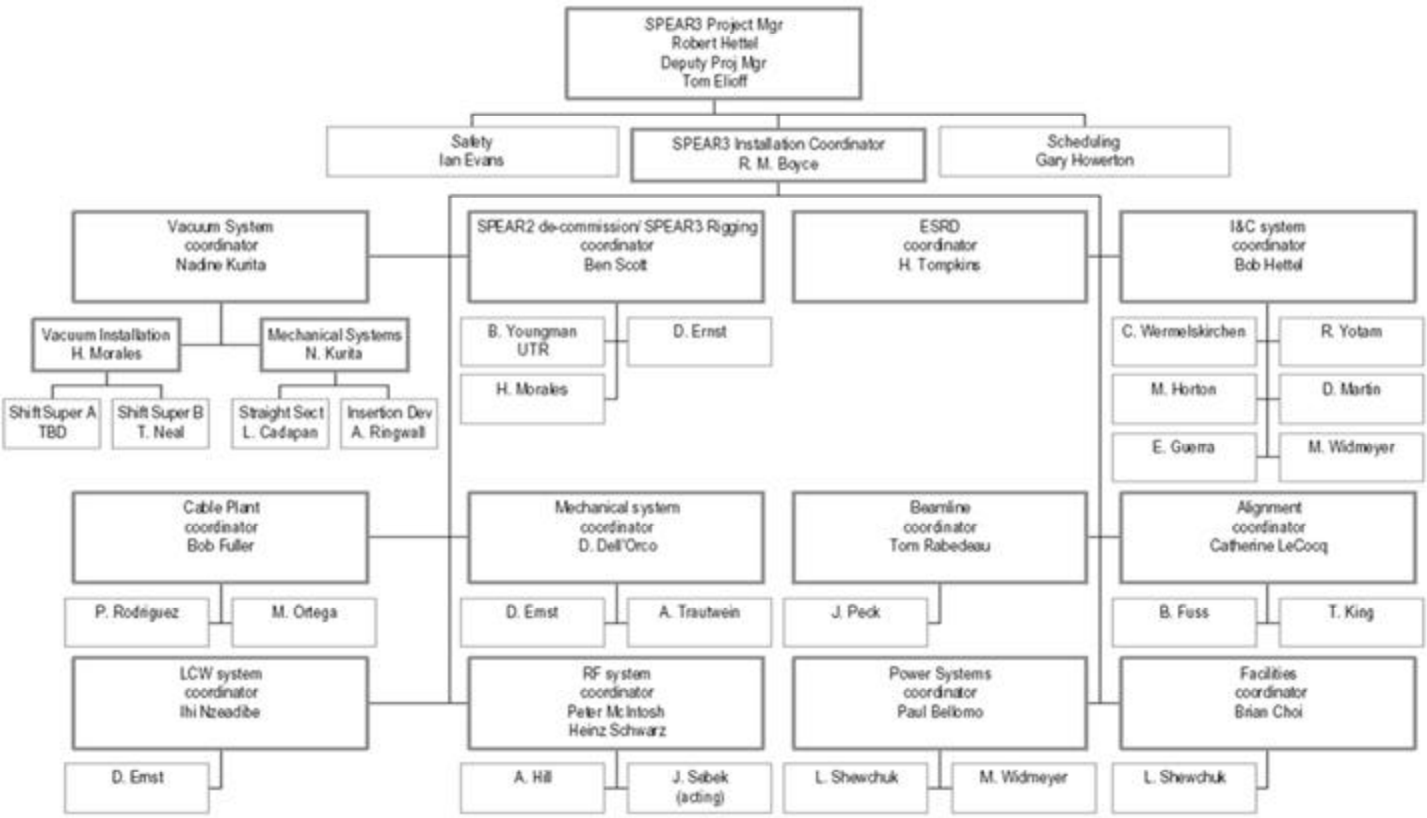
As noted above, the SPEAR 3 installation program was initiated on schedule March 31, 2003 following the final operations and shutdown of the SPEAR 2 storage ring. In this quarter progress continued toward establishing the final schedule of the many details for terminating and removing SPEAR 2, improving and modifying the facilities, and installing the new SPEAR 3 ring. Also, most of the major contracts associated with the Installation program were developed, sent out-to-bid and awarded.

2. Future Reporting

As noted above, the focus of the SPEAR 3 project is changing from Design, Fabrication, and Production to Installation. The Installation program is based on a very fast track schedule and future reports will be on a monthly basis. While we will continue to report on the above WBS 2 level efforts until their completion, the major focus of the monthly report will be the Installation effort WBS 1.9. The organization and reporting chart for Installation is reflected in the chart below. The third level WBS 1.9 elements have been modified to reflect this structure as follows:

1.9 Installation and Alignment
- 1.9.1 Magnet & Supports
- 1.9.2 Vacuum System
- 1.9.3 Power Supply System
- 1.9.4 RF System
- 1.9.6 Cable Installation
- 1.9.7 Beamline Front Ends
- 1.9.8 Facilities
- 1.9.9 Management & ES&H
- 2.0.1 S2 decommissioning and S3 rigging
- 2.0.2 Survey & alignment

SPEAR3 Installation reporting chart



3. Current Costs

The total project costs and commitments through March of this quarter are provided in Table A1. The integrated costs and commitments per month are plotted in Fig. A1.

Table A1
Costs and Obligations
(through March 2003)

	K$	
	Direct	Direct & Indirects
Costs	38,556	43,674
Commitments	3,833	4,216
Total	42,389	47,890

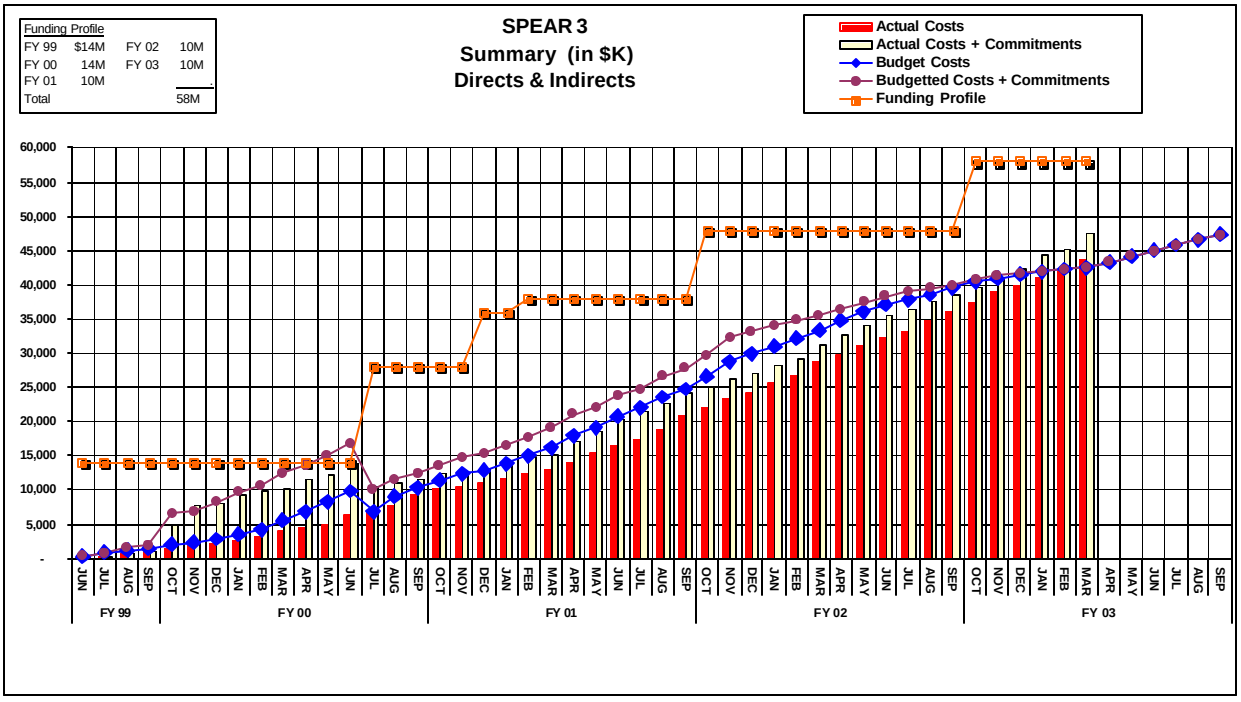


Figure A1

Table A2 provides the project performance data with associated cost and schedule variances at WBS Level 2. The monthly variance record is given in Fig. A2. The negative schedule variance has not changed significantly since the last report. It is due primarily to delays of various vacuum system components. Section 1.2 calls attention to the estimated completion of these vacuum components some of which are delayed to June 2003, thus using the built-in float assuming completion by April 1. Appropriate schedule revisions and CCB actions will be undertaken next month in particular to revise the cost estimate for Instrumentation & Controls, Facilities, and Management/Support. Note that the last CCB actions occurred October 4, 2002 and 3.4M$ remains for contingencies at this time.

Table A2

Cost/Schedule Status Report				
	Contract Type/No:	Project Name/No: SPEAR3 Project - rev. A ($58M)	Report Period: 2/28/2003 3/31/2003	Signature: Title/Date: 5/1/2003
(1) Original Contract Target Cost	(2) Negotiated Contract Changes	(3) Current Target Cost (1) + (2)	(4) Estimated Cost of Authorized Unpriced Work 0	(5) Contract Budget Base (3) + (4) 57,995

Performance Data								
	Cumulative to Date					At Completion		
WBS[2]	Budgeted Cost		Actual Cost	Variance				
	Work Scheduled	Work Performed	Work Performed	Schedule	Cost	Budgeted	Latest Revised Estimate	Variance
1.1 Magnets and Supports	8,850	8,642	8,536	-208	107	9,149		
1.2 Vacuum System	10,554	10,119	9,889	-436	230	12,215		
1.3 Power Supply System	3,276	3,180	2,504	-96	676	3,514		
1.4 RF System	4,267	4,169	4,166	-98	3	4,624		
1.5 Instruments Control & Protection Systems	2,769	2,576	2,911	-193	-335	3,633		
1.6 Cable Plant	2,119	2,071	1,998	-48	73	2,597		
1.7 Beamline Front Ends	952	921	979	-31	-58	1,056		
1.8 Facilities	3,311	3,352	3,346	42	6	3,509		
1.9 Installation and Alignment	0	0	341	0	-341	5,165		
1.0 Mgmt, Support, & Accelerator Physics	3,395	3,395	3,786	0	-391	4,037		
Gen. and Admin.	5,142	5,142	5,218	0	-77	6,238		
Undist. Budget						0		
Sub Total	44,635	43,568	43,675	-1,067	-107	55,737		
Management Resrv.						2,258		
Total	44,635	43,568	43,675	-1,067	-107	57,995		

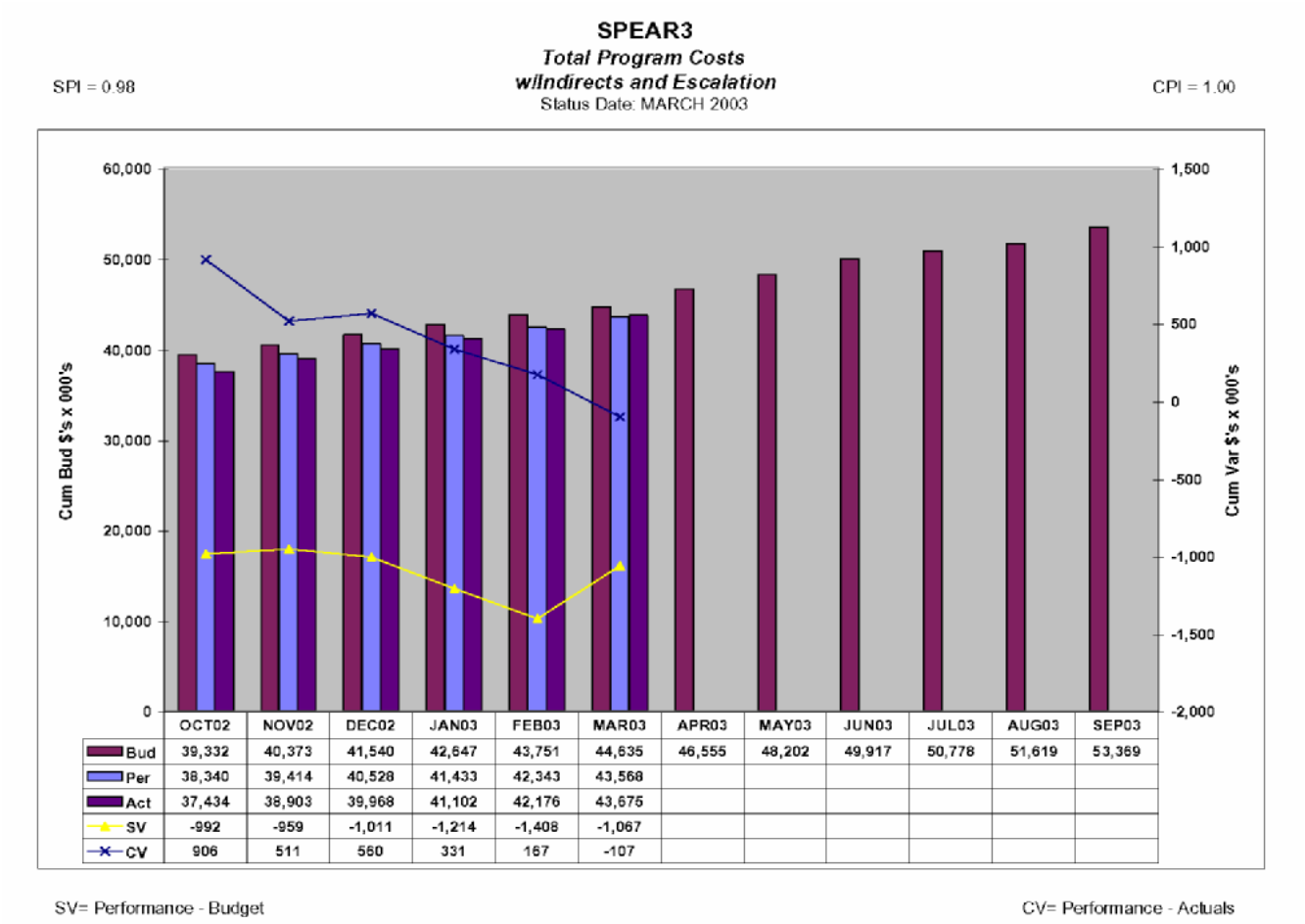


Figure A2

B. Detailed Reports

1.1 Magnets and Supports

The work this quarter involved continuation of the production of main ring rafts and completing the magnets for the injection Beam Transport System (BTS). The main ring raft production involves the assembly and alignment of the magnets with associated vacuum chambers. In the beginning of this quarter the raft production reflected some delays due to vacuum chamber production. At the end of March only 3 vacuum chambers remain to be baked-out. Production of 46 rafts is complete and the remaining 8 units are scheduled for April and May.

The BTS raft magnets are all completed and measured magnetically. The vacuum chambers for the raft magnets were built and the raft frame itself was modified to support all the magnets with a six struts system. The raft integration will start as soon as manpower is freed from SPEAR 2 removal activities.

The high permeability insert for the septum magnet was machined and heat treated at SLAC together with two sample pieces. The sample measurements showed a high magnetic permeability. The assembly of the Septum magnet was completed and the magnet will undergo magnetic measurements in April.

1.2 Vacuum System

The engineering efforts and manufacturing milestones during the past quarter have been the following,

Completed the vacuum processing of the standard BM-2 chambers.
Completed the assembly of the QFC beam dump chamber.
Completed the assembly and welding of the matching chambers.
Completing the vacuum processing of the matching chambers and the QFC chambers.
Completed the major welding of the septum chamber.
Completing the fabrication of the piece parts for the injection chambers.
Fabricated the piece parts for the RF HOM chambers and started their assembly.
Fabricated the piece parts for the RF bellows and completed the brazing.
Completed the drawings for the RF transition chambers.
Completed the designs of the standard straight transitions and the specialty insertion device transitions.
Started the fabrication of straight section elliptical tubes.
Fabricating a 48” copper plating facility at SLAC.
Started the assembly of the PPS stopper chambers.
Completed the fabrication and assembly of the straight section rafts.
Fabricating the Septum Chamber/Magnet raft.
Completing the detail drawings for the DCCT and injection drift and transition chambers.
Started the fabrication of the DCCT chamber piece parts.
Procured the ion pumps, isolation valves and vacuum gages.

Standard Girder Chambers

BM-1 & BM-2 Standard Chambers
The vacuum processing of the BM-1 chambers were completed this past quarter and all the chambers are assembled onto their rafts.

The BM-2 chamber welding, assembly and vacuum processing was completed this quarter. Chambers are currently being assembled onto their rafts.

Matching BM-1 and BM-2 Chambers

The matching chamber assembly was completed this quarter and all the chambers are in vacuum processing and should be complete by April.

Figure 1: BM1-MCB Final Fiducialization

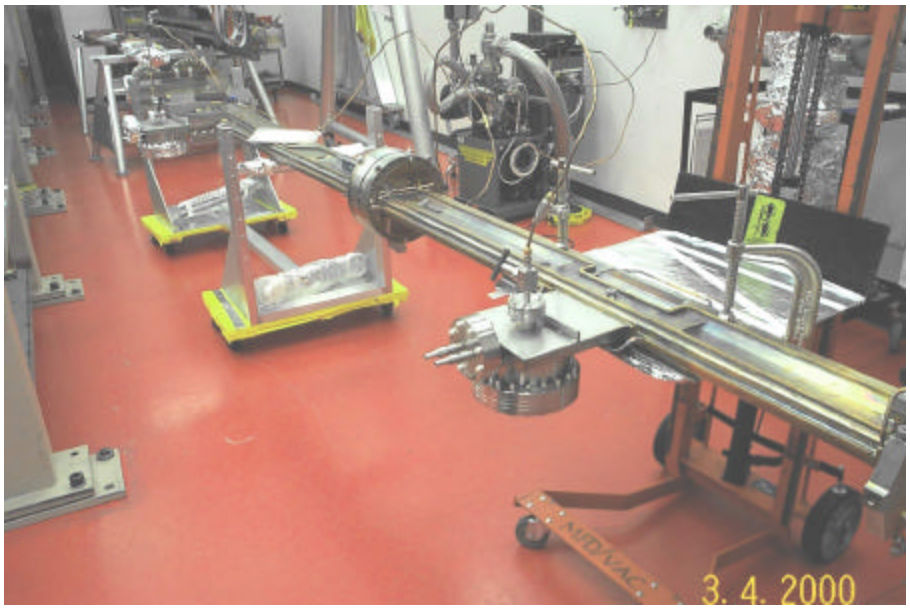


Figure 2 MCA BM2 Final Chamber Interconnection

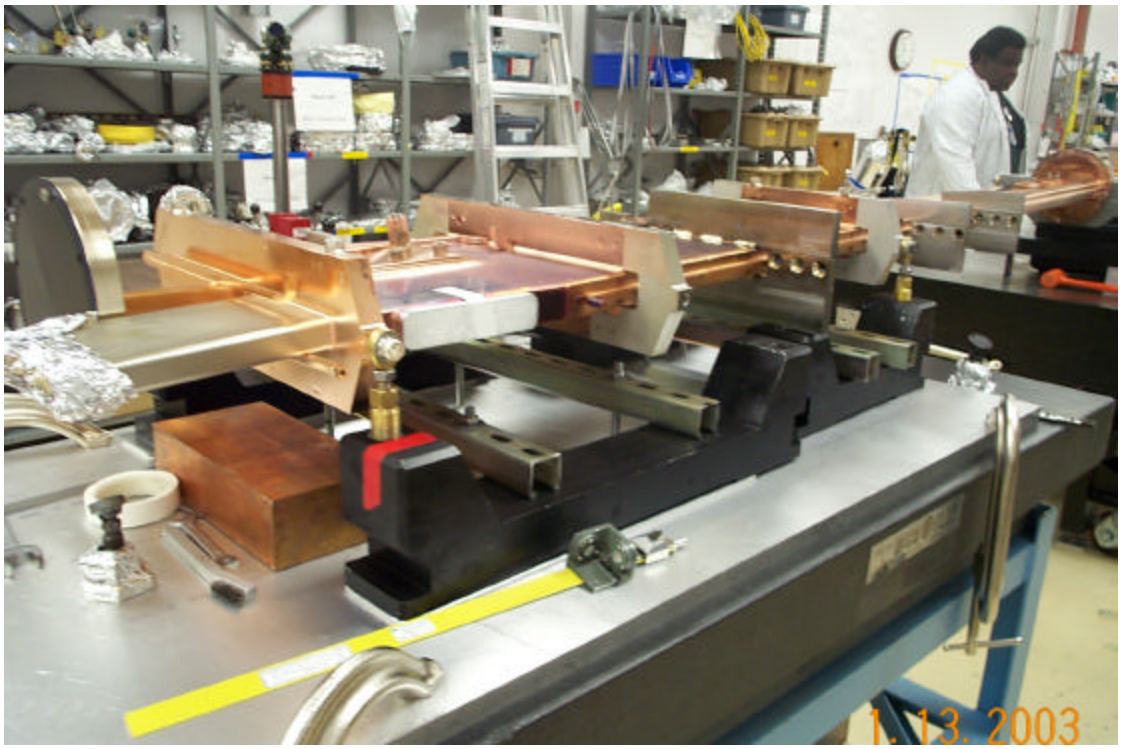


Figure 3 & 4: BM2-1 and BM2-2 Alignment and fiducialization of both chambers.

Beam Dump Chamber

A standard QFC chamber was modified into a beam dump chamber. This chamber was an addition to the scope of the project in order to reduce radiation shielding for the ring. The chamber was redesigned and fabricated this quarter. It is currently on bake and should be ready for installation in April.

Figure 5: Beam Dump Chamber

Diagnostics

The PPS stopper brazing and assembly started late this quarter and should be completed by May.

The DCCT piece parts were ordered this quarter. Assembly should start in May and the chamber should be ready for testing in June.

The synchrotron light monitor primary mirror fabrication continued this quarter and is scheduled to arrive in April.

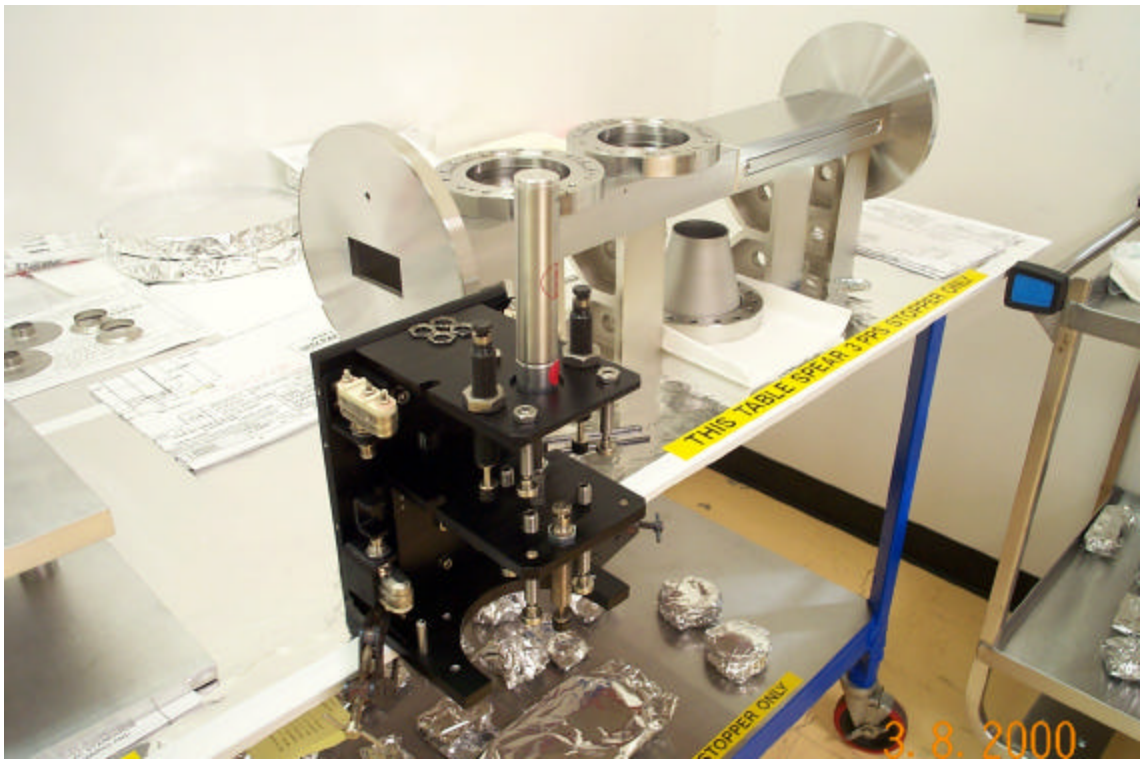


Figure 6: PPS Stopper Chamber

Straight Section

Rafts/Supports

The straight section rafts, modular supports and rod ends were received this quarter. The Septum Chamber/Magnet raft is in fabrication and will be here in April. The anchor bolt installation contract is underway and template drawings are complete for all the straight sections excluding the existing insertion device straights.

Figure 7: Straight Section Raft

Specialty Transitions

The piece parts for the kicker and septum transition chambers were ordered this quarter and assembly should start in late April and should be ready for installation in July.

The detail drawings for the existing insertion device transitions should be complete in April.

Straight Section Drift Chambers/Transitions

The elliptical drift chambers are in fabrication and a plating facility to accommodate 48" tubes is being built at the SLAC mechanical fabrication department. The transitions for the straight chambers are out for procurement.

RF Straight Chambers

The assembly of the RF straight bellows started this quarter. The parts were successfully brazed and welded. The final assembly should be ready for bake by the end of April.

The HOM tube for the RF straight is being assembled and should be complete by May. The RF drift tubes are in fabrication and should be complete by June.

Injection System

The septum chamber main body EB and tig welding was successfully completed this quarter. The thin septum nose weld was also performed. The chamber window is currently being brazed and tested and the chamber should be complete by June.

Figure 8: Injection Septum EB Box Weld

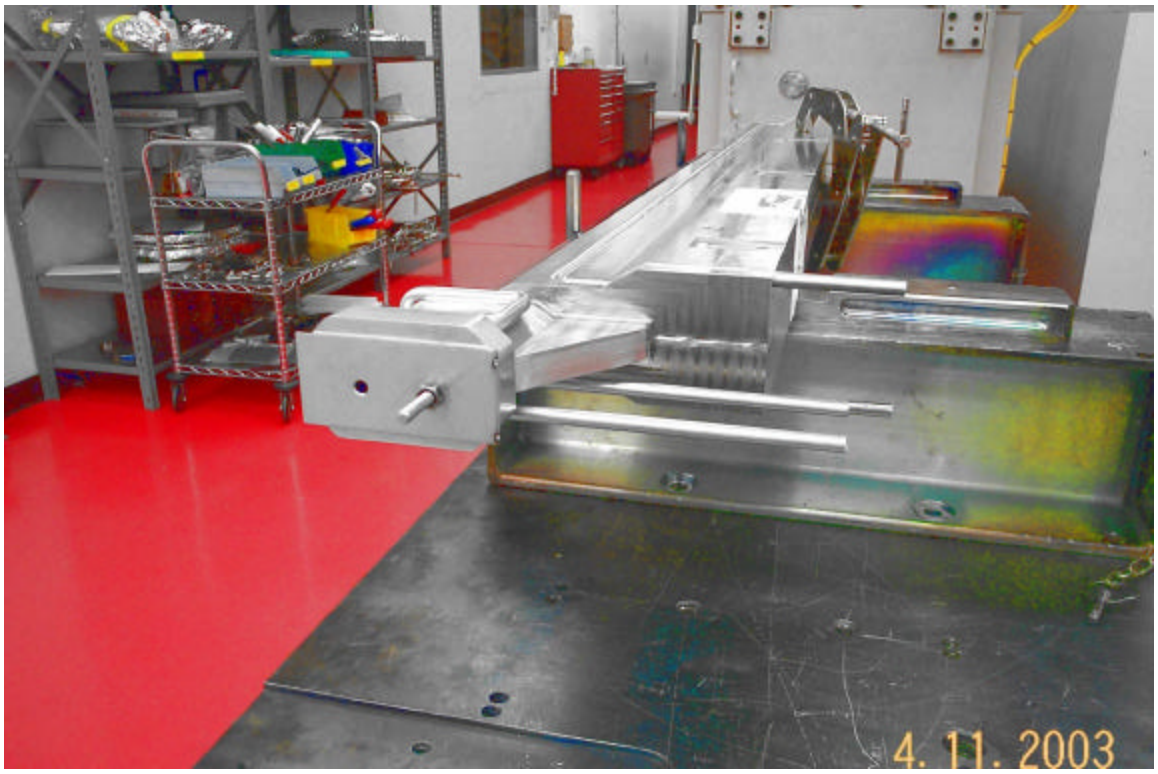


Figure 9: Injection Septum Transition Welds

The kicker chamber assembly started this quarter.. The assembly is scheduled for completion by July.

Bellows Modules

The piece parts for the bellows module were ordered this quarter and assembly should begin in May. The bellows should be complete by July.

The tune driver bellows piece parts arrived this quarter and the assemblies will be complete in May.

1.3 Magnet Power Supplies

Unipolar Power Supplies

Dipole Bulk Power Supply

Alpha Scientific has completed the fabrication of the 1500V, 800A, 1200VA Dipole Bulk Power Supply. Factory testing was delayed because programming of the Allen-Bradley Programmable Logic Controller consumed more time than originally anticipated. However, testing has begun and is proceeding smoothly. Since Alpha's facility and load are power limited, the bulk power supply will be tested at a power level considerably below its 1200kVA rating. There was a plan to test it at substantial power levels in Building 108 when it arrives at SLAC. However, the early start of E158 experiments has negated that plan. The contemplated alternative approach is to test the bulk power supply to about 300kW of output in Building 15. Bulk Power Supply will be ready when needed for installation.

Dipole Chopper Modules

The 4 chopper modules depicted in the photograph below have been successfully operated as an integrated series-parallel connected set. An output of 300V, 200A, 60kW was attained using a limited-power test facility. It is important to note that the operation tested not only the integrated operation of the four chopper modules, but also the integrated operation the two chopper modules and BitBus controller shown in the photograph. The chopper system will be available to support installation.

Dipole Chopper Module Rack

Large Power Supplies

All 6 large power supplies have been tested and delivered to the B130 staging area awaiting installation.

Intermediate Power Supplies

IE Power has started delivery of the 80 Intermediate Power Supplies. Twenty have been delivered as of the end of this reporting period. These twenty are being "bench tested" as integrated systems in Building 24. The tests include everything in the system with the exception of the actual magnet load. By necessity, a "dummy" resistive-inductive load is used for these tests. The IE Power deliveries are picking up steam and their deliveries will support the installation effort.

Bipolar Power Supplies

All 150 bipolar power supplies are ready for installation. These will power corrector, dipole trim, quadrupole modulation, skewquad and insertion device trim magnets.

Pulsed Power Supplies

Kicker Pulsers

The K1, K2 and K3 pulsers have been assembled and tested. The problem of the finger stock discussed in last month's report has been solved by the purchase and retrofit of a superior finger stock design. At the moment work continues in an effort to optimize the output current pulse waveform. Other than this minor task, the three pulsers are ready for installation.

AC Power Distribution

With the exception of five 480V motor control centers, all AC distribution equipment has been received and are in the B130 staging area. At SLAC request, the five motor control centers are being held by Cutler-Hammer at their facility for an April 1st delivery when Building 130 is again available for use. The AC distribution equipment deliveries will support the installation effort.

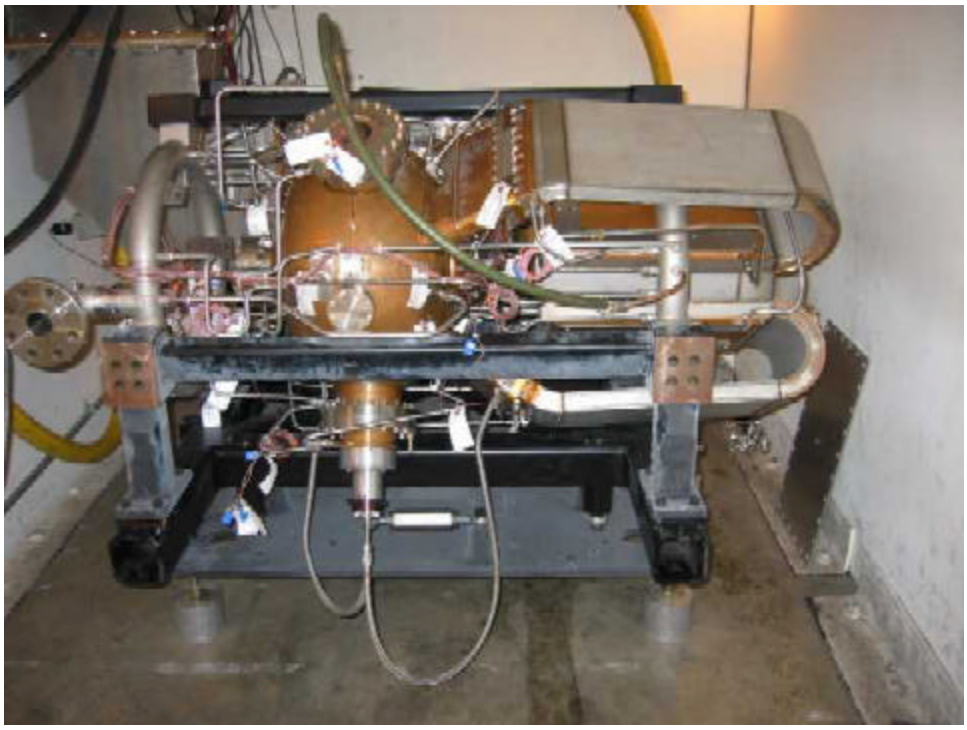
Building 118 Refurbishment

Farris Electric is the chosen subcontractor to remove the end-of-life components and power supplies from B118. In a second phase of the subcontract, Farris will also install new SLAC-supplied lighting, AC distribution equipment and power supplies. Kickoff meetings have been held with Farris to review safety plans, hazard analysis and schedules. Farris will mobilize for the start of work on or about March 28th to support demolition start.

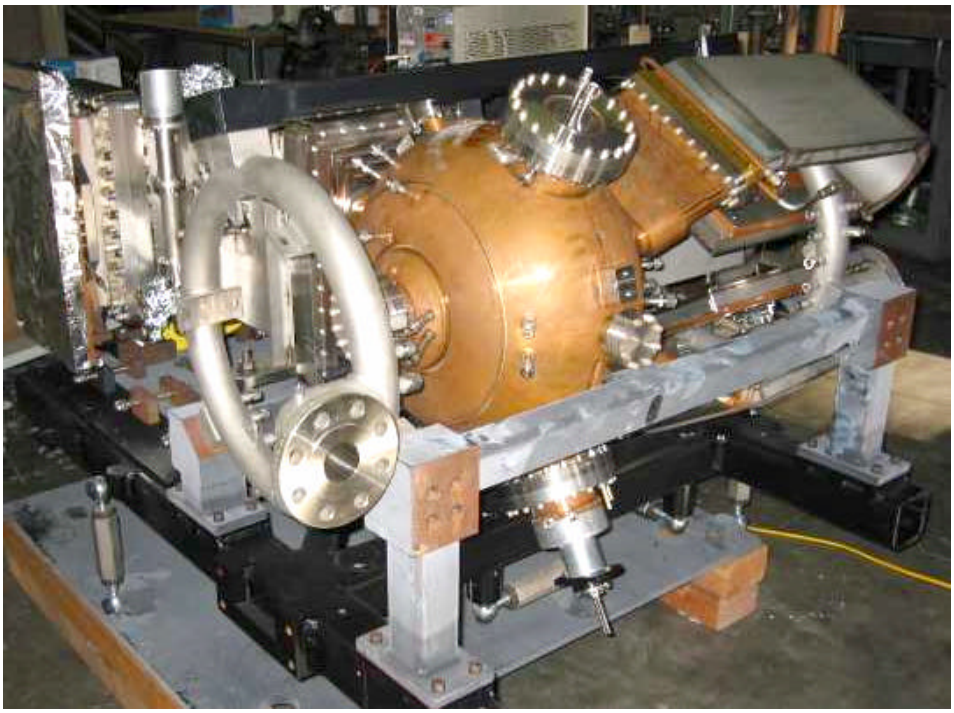
1.4 RF System

Cavities

Four RF cavities are being fabricated at Accel. Instr. in Germany.
Two cavities have been delivered early in March and are being assembled at SLAC. Pre-processing of the first cavity starts March 28 (See figure below). Two more cavities are scheduled to be delivered in mid April and will be assembled and pre-processed by May for installation into SPEAR 3 in August 2003.



First SP3 cavity #1 assembled and ready for RF processing in the test bunker



SP3 cavity #2 in final assembly

Klystron High Voltage Power Supply

The HVPS for the SPEAR 3 klystron was moved into its final location and connections to supply line and klystron are in progress.

Low-level RF

The VXI modules for the Low-level RF System were fabricated at the Electronics & Software Engineering Department at SLAC. Testing is in progress
The control racks have been installed with most of the auxiliary chassis in place.
Work on software for SPEAR 3 RF continues.

Some Low-level RF VXI modules ready for final testing

1.5 Instrumentation and Control Systems

Computer Control System

The software development group is making substantial progress in implementing EPICS IOCs using the open RTEMS real-time operating system (in place of proprietary VxWorks), configuring the control system infrastructure and control database, and establishing operation of data acquisition and control interface modules. In particular, the Bitbus control software for 70+ power supplies was implemented and tested, work on BPM data acquisition and corrector power supply control software continued, and field bus interfacing of remote programmable logic controllers was established.

All components of the fast, 8-channel corrector power supply controller have been designed and are in production. Acceptance testing of some units has begun. Data processing firmware for the components has been completed with the exception of the time-stamp receiver firmware.

Testing of the triggerable 8-channel, 16-bit ADC IP module continues with a modified design received from the vendor. Other multi-channel input and output interface modules have been specified; digital input modules for the Orbit Interlock and output modules for the QMS and TSP switchyards have been procured and are being tested.

Detailed interconnection diagrams for the computer control system are in production.

Beam Monitoring Systems

Testing of the 60 4-button-multiplexed BPM processing modules from Bergoz continues. Interconnection components needed between the BPM processing system are being fabricated, and the first BPM-ADC Interconnect chassis is being tested. The specification of BPM long-haul cables is complete and the specifications for jumper cables is in progress. Equipment racks for the BPM system will be received in mid-April.

The design of the LO, Clock and Test Tone fan-out units is in progress, as is the design of the tune monitor, bunch monitor, and BPM-based current monitor. Detailed interconnection diagrams for all beam-monitoring systems have been completed and submitted for official documentation.

Quadrupole Modulation System

The Quadrupole Modulation System switchyard will be controlled by CAMAC digital interface components. Design of QMS was assigned to the SLAC Power Conversion Group and fabrication is complete.

Timing System

The RF/Timing Signal Generator system from Wenzel was received and is being tested. Fabrication of the Booster RF Signal Generator and phase shifting unit is complete. The design of the Injection Timing Controller, which communicates with the Booster RF Signal Generator, has begun, but delivery of this unit is not expected until early June. The Clock/Sync Distribution units are complete.

Protection Systems

Detailed configuration of the programmable logic controller systems for the vacuum and magnet water protection interlocks is in progress and is nearing completion. Ion pump power supplies have been received and ion gauge controllers have been ordered Interconnection diagrams for machine protection components are in production.

The Orbit Interlock Position Limit Detector chassis are in production. The design of the central Orbit Interlock Summary chassis is nearing completion. Computer interface modules have been selected.

The design of the Beam Current Interlock that prevents beam lines not rated for high current operation from being opened above specified beam current levels is in progress. The use of this and other beam containment components, including Average Current Monitors and Long Ion Chambers, will be reviewed by the SLAC Radiation Safety Committee in the next quarter.

1.6 Cable Plant

The Phase 1 Cable Plant Installation consisting of DC and Vacuum cables was completed on March 24, 2003. Although some cables were previously installed much work was done pre-terminating the cables in advance of SPEAR 3 Ring access, thus minimizing time-in-ring work.

Work has begun on the Phase 2 Cable Plant package for installation. Updates were made to the DC portion (Phase 1) from Engineering details and as-builts supplied by the installers in the field. Updates to the tray design were necessary as detailed cable information became available from the Instrumentation and Control (I&C) Engineering Team for Phase 2 installation.

A review of Phase 1 cableplant CAPTAR coding sheets for detail updates of I&C cables is underway. Bulk cables were installed without specifics as to exact elevation or connector types until SSRL Engineering made determinations. Routing of I&C cables (Phase 2) along with specific lengths is nearing completion and is being made ready for CAPTAR DB downloading. CAPTAR DB Output is being gathered with respect to cable and connector types as the basis for the procurement which is now in process.

Detailed reviews of the removal and installation schedules has been performed and optimized. With this work the Cableplant team was able to reduce the overall schedule by nearly 3 weeks. Rack profiles for the DC systems have been reviewed and updated.

1.7 Beam Line Front Ends

The past three months have witnessed substantial progress in the fabrication of beam line front end components which are now assembled and awaiting installation. All insertion device (ID) beam line moveable masks are in braze or final assembly. While early braze difficulties have definitely hampered progress on these masks, recent braze successes at SLAC and at an external vendor suggest these problems are receding. Machine fabrication of four of the six ID fixed masks is complete. Machining of the remaining two ID fixed masks is scheduled for completion in early May. Braze processing of these masks will follow the completion of the ID moveable mask braze assemblies.

Detailed planning of SPEAR 2 front end removal was completed at the end of March. SPEAR 2 front end decommissioning and removal is scheduled for the month of April. Detailed analysis of the bend magnet beam line realignment required by the relocation of the SPEAR 3 bend magnet source points was completed in March. Bend magnet beam line realignment is scheduled to commence in late April and continue through May.

1.8 Facilities

Planning and design efforts are continuing for the construction of a new 18" reinforced concrete floor in the SPEAR tunnel as well as a new 8" reinforced concrete floor for the Building 118 Power Supply building. The work will include excavation and removal of existing asphalt, concrete and soil followed by installation of grounding wire, steel reinforcements and concrete.

A contract has been awarded for the execution of this effort which is scheduled to begin May 8, 2003. The contract requires that this company demonstrate its ability to pour the tunnel floor within a required flatness via a sample section of tunnel floor 20 feet long. The construction of this sample section is shown below. The survey indicated that it met the SPEAR 3 requirements.

Construction of sample tunnel floor section in progress.

1.9 Installation

The SPEAR 3 installation plan was initiated on schedule March 31, 2003 following the final operations and shutdown of the SPEAR 2 storage ring. During this quarter progress continued toward establishing the final schedule of the many details for terminating and removing SPEAR 2, improving and modifying the facilities, and installing the new SPEAR 3 ring. The project worked on various scenarios to enhance our ability to plan and optimize these phases of the installation. Also an organization responsibility chart for the various technical systems was established together with their associated manpower. This provided an updated installation cost plan.

Detailed specifications and bid packages were developed for the major contracts which were sent out-to-bid and awarded. These included:

- Rigging for SPEAR 2 removal and for installation of SPEAR 3 magnet rafts.
- Excavation and new reinforced concrete floors in the tunnel and the power supply building.
- Power Supply removal and installation of new supplies.
- Modification of the LCW System.

The awards for these contracts were well within the projected project costs. Only the Phase 2 cable contract and the contract for straight section supports remain to be awarded.

The overall installation plan is summarized below. These dates reflect the current 7-month schedule estimated with 10 hour workdays at 5 days/week for all activities with two shift operations for vacuum integration work.

SPEAR 3 Installation timeline

- Begin April 2003
- SPEAR 2 remove : Mar 31 – May 8
- B118 renovation: Mar 31 – Oct 6
- Pour concrete floor: May 08 – Jun 20
- Install new monuments: Jun 20 – Jul 25
- Install mounting plates & holes: July 1 – Aug 11
- Install Girders & Straights & shielding: Aug 11 – Aug 29
- Install cable plant: Aug 25 – Oct 15
- Install vacuum hardware & BL Front Ends: Aug 18 – Oct 16
- Leakcheck ring/beamlines- pumpdown : Sept 08 – Oct 22
- Final Survey: Oct 22 – Oct 30
- Lock Ring-Installation complete: Oct 30, 2003

2.1 Accelerator Physics

Booster Operation at 3 GeV

A coordinated program was carried out to operate the booster synchrotron at 3 GeV in parallel with SPEAR operations. New transformers needed to be "broken in" and critical supplies monitored for temperature rise. Measurements proved comparable to successful but less aggressive tests made in 2002. Problems with the extraction kicker were largely resolved by relocating an arcing trigger wire closer to the thyratron (wire floats up to ~20kV during kicker pulse). The booster was also operated at a new rf frequency commensurate with the as-built path length. SPEAR 3 was designed with this frequency shift taken into account. The electron beam was then successfully steered down the BTS. Optical correction taking into account "phase-ellipse" distortions at window elements lead to improved injection in SPEAR 2 and a better understanding of BTS operation. Overall, the booster is tested and ready for 3 GeV operation.

Day-1 Lattice Specification

Magnetic measurement data obtained from the SLAC measurement laboratory contains vital data on effective magnet length and current-to-field transfer functions. Based on this data (and engineering drawings calling out final element positions) the 'as-built' file for the lattice model has been assembled. The modified file contains effective magnet lengths for the dipole and quadrupole magnets. The strength of these magnets has been numerically re-matched to achieve the design optics (Qx=14.19, Qy=5.23). We are beginning efforts to specify precise power supply currents required to excite the magnets to the specified field strength. Although empirical transfer functions are known from magnetic measurements, some screening effects need to be compensated due to the proximity of quadrupole magnets to the mirror plates on the corrector magnets. As the mirror plates decrease the integrated field strength by up to 2%, the effect cannot be neglected. Current plans are that each quadrupole magnet family will have uniform transfer functions used across the magnet family with magnet-by-magnet scaling factors to take mirror plate effects into account. The individual scaling factors will also be used when beam becomes available for beam-based model calibration. The accelerator physics group is closely integrated with web documentation of magnetic measurement data.

Synchrotron Light Monitor

Progress on the synchrotron light monitor included a review of the 'front-end' components in the tunnel (absorber, gate valve, vacuum system, clearing magnets), laboratory installation of the optical bench, installation of alignment monuments, design and procurement of radiation protection box components, specification of the vacuum pump system, purchase of critical mirror and mirror mount components and installation of the power rack and a/c power. A significant design change was made going away from electronic movers and electronic position sensors to manual movers (micrometers) and manual position sensors (dial indicators). These changes save significant capital and reduce setup and maintenance work loads while achieving comparable mirror position accuracy. A smaller review was also held to integrate the light monitor valve/vacuum gauge assembly into the main SPEAR 3 machine protection system. Requests for vacuum MPS and water flow MPS have been made to cable plant personnel. Review of the x-ray absorber (cold finger) and M0 mirror is anticipated in April.

Application Programs

Progress in application programs continued on a program to globally align the electron beam to quadrupole centers (global beam-based alignment), the orbit interlock verification program and efforts to utilize the model server to test programs. Components of the orbit interlock system have been integrated into the model server to operate the program in a realistic Day-1 mode. All application programs were converted from 'physics units' (meter, radian, field strength, etc) to hardware units (mm, amps, etc). Initial studies of dispersion correction were completed and integration into the main orbit correction code is underway.

Radiation Physics

Formal study and documentation of the electron beam loss scenarios was completed and documented for the upcoming Radiation Physics Review for SPEAR 3. The primary documents are:

1. Electron Beam Loss Estimates in SPEAR 3 (SSRL-ENG-NOTE M371)
2. Injection Beam Loss Angle (SSRL-ENG-NOTE M423)
3. SPEAR 3 Main Ring Stoppers (SSRL-ENG-NOTE M426)
4. SPEAR 3 Fixed-Radius Beam Collimator (SSRL-ENG-NOTE M427)
5. Physical Apertures in SPEAR 3(SSRL-ENG-NOTE M428)